What is claimed is:

1. A tool for monitoring system operation, said tool comprising:

a data acquisition unit, said data acquisition unit receiving signals from sensors, said sensors being disposed upon a system being monitored and providing parametric snapshots of system operation;

a memory storing a training set, said training set containing a plurality of system vectors, each of said system vectors being representative of an expected operating state of said system being monitored;

a processor receiving snapshots from said data acquisition unit and comparing received snapshots with system vectors from said memory, said processor selectively applying a lensing similarity function to said comparison; and

an output unit, said processor providing results of said comparison to said output unit.

2. A tool as in claim 1, said processor comprising a similarity engine, said similarity engine receiving said snapshots from said acquisition unit and training set vectors from said memory and applying said lensing similarity function to said received vectors to generate a similarity vector, said similarity engine selectively providing said similarity vector to said output device.

3. A tool as in claim 2, said processor further comprising an estimated state generator receiving said similarity vector from said similarity engine and training vectors from said memory and generating an estimated state therefrom, said estimated state being selectively provided to said output device.

4. A tool as in claim 3, said processor further comprising a deviation detection engine, said deviation detection engine receiving snapshots from said data acquisition unit and estimated states from said estimated state generator and determining deviation therefrom, said deviation detection engine selectively

providing said determined deviation to said output device.

5. A tool as in claim 4 wherein said lensing similarity function defines a similarity domain, vectors belonging to said training set falling on said similarity domain, snapshots being expected to fall within said similarity domain, each said snapshot's location within said similarity domain being a basis of said comparison by said processor.

6. A tool as in claim 5 wherein the lensing similarity function is representable as a line segment selected from the group consisting of a polynomial segment, an elliptical arc, a trigonometric segment and a circular arc, said line segment defining said similarity domain.

7. A tool as in claim 5 wherein said lensing similarity function comprises selecting a line segment from a non-planar surface, said line segment defining said similarity domain.

8. A tool as in claim 4 wherein the lensing similarity function comprises moving the comparison angle apex with respect to a similarity domain, vectors belonging to said training set falling on said similarity domain, snapshots being expected to fall within said similarity domain, each said snapshot's location within said similarity domain being a basis of said comparison by said processor.

9. A tool as in claim 4 wherein the lensing similarity function comprises extending a comparison angle range beyond 90o, rays from said comparison angle contacting outer limits of a similarity domain, vectors belonging to said training set falling on said similarity domain, snapshots being expected to fall within said similarity domain, each said snapshot's location within said similarity domain being a basis of said comparison.

10. A tool as in claim 4 wherein said monitored system is selected from the group consisting of a machine, a process and a biological system.

11. A method of generating a lensing function for a similarity operator for use in modeling operation of a system and monitoring said system during operation to determine if said system is performing within accepted parameters, a method comprising the steps of:

a) collecting a plurality of system snapshots representative of normal system operation;

b) identifying minimum and maximum vectors within said collected snapshots, said identified minimum and maximum vectors defining a training set for said system;

c) selecting a lensing function, said lensing function allowing an operator to provide enhanced scrutiny to selected areas of operation;

d) generating a similarity domain surface for each degree of said vectors in said training set using said lensing function; and

e) storing said similarity domain surface.

12. A method as in claim 11, during monitoring of said system operation said method further comprising the steps of:

f) selecting an apex height; and

g) selecting a similarity operator line segment responsive to said selected apex height, vectors belonging to said training set falling on said similarity domain surface, snapshots being expected to fall within said similarity domain surface, each said snapshot's location within said similarity domain being a basis of said comparison by said processor.

13. A method as in claim 12, during monitoring of said system operation said method further comprising the steps of:

f) selecting an aspect ratio; and

g) selecting a similarity operator line segment responsive to said

selected aspect ratio , vectors belonging to said training set falling on said similarity domain, snapshots being expected to fall within said similarity domain, each said snapshot's location within said similarity domain being a basis of said comparison by said processor.

14. A method as in claim 11 wherein said lensing function is an algebraically defined contour, said lensing function shaping said surface.

15. A method as in claim 11 wherein said lensing function is a sinusoidally defined contour, said lensing function shaping said surface.

16. A method as in claim 11 wherein said lensing function is a polar contour, said lensing function shaping said surface.

17. A method as in claim 11 wherein said monitored system is selected from the group consisting of a machine, a process and a biological system.

18. An apparatus for monitoring a system having monitored parameters, comprising:

a memory for storing a plurality of reference snapshots of said parameters;

an estimation engine disposed to receive a snapshot of parameter values representing a condition of said system, and generate a snapshot of at least one estimate of a parameter of said system, using a lensing similarity operator; and

a differencing engine for determining a difference between said estimated snapshot and the received snapshot.

19. An apparatus according to Claim 18 wherein said differencing engine successively differences said estimated parameter and a corresponding parameter value from said received snapshot to provide sequence of residual

values, and performs a sequential probability ratio the sequence.

20. An apparatus according to Claim 18 wherein said differencing engine successively differences said estimated parameter and a corresponding parameter value from said received snapshot and tests the resulting difference against a threshold.

21. An apparatus for monitoring a source of data for determining an operating state of a selected system, comprising:

a first data source for providing reference data parameters characteristic of at least one operating state of a reference system;

a second data source for providing selected data parameters from said source of data which are characteristic of an operating state of the selected system;

a computer module operative to determine a measure of similarity between said selected data parameters of said selected system and said reference data parameters of said reference system, using a lensing similarity analysis.

22. An apparatus according to Claim 21 wherein said computer module is operative to determine for each pair of corresponding parameters from said selected data parameters and said reference data parameters, a length along a selected curve proportional to the difference of such pair of corresponding parameters, and an angle formed by lines drawn from the ends of the length to a selected vertex, and generate a similarity value for such corresponding pair based on said angle.

23. An apparatus according to Claim 21 wherein said computer module is operative to determine for each pair of corresponding parameters from said selected data parameters and said reference data parameters, a length along a selected curve as a function of a length along an ordinate axis to said curve proportional to the difference of such pair of corresponding parameters, and an

angle formed by lines drawn from the ends of the length along said curve to a selected vertex, and generate a similarity value for such corresponding pair based on said angle.

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